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August 4, 1999

PATENT APPLICATION
Attorney's Docket No: TEX98-01A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	David M. Mayes	Application No.:	09/019,667
Application No.:	09/019,667	Prior Group Unit:	2877
Filed:	February 6, 1998	Prior Examiner:	Nguyen, T.

Title: GRAIN QUALITY MONITOR

SECOND DECLARATION OF DAVID M. MAYES

Sir:

1. My name is David M. Mayes.

2. I presently reside a 807 Penn Avenue, LaGrande, Oregon 97850.

3. I am the inventor in the above-referenced patent application.

4. I hold a doctorate degree in Chemistry from the University of Washington, in Seattle, Washington.

5. I am generally familiar with the applications of spectroscopy, including those in the food industry.

6. I am President of a Company called DSquared Development of LaGrande, Oregon. Among other products, DSquared Development sells spectrophotometer systems

including the DPA spectrophotometer system which I described in my declaration dated March 8, 1999 and previously filed in connection with the above-referenced patent application.

7. On or about December 5, 1995, I sent a letter to Mr. Bob Horning of a company called Micro-Trak located in Eagle Lake, Minnesota. A copy of that letter is attached hereto as Appendix A.

8. In that letter I described to Micro-Trak a proposed real-time grain monitor that I felt at the time could be "implemented to analyze grain and other agriculture products in real-time while being harvested".

9. I also proposed in that letter that the device could be "mounted directly in a combine or similar implement".

10. At the time of drafting that letter, DSquared Development had already been selling spectrophotometers for a number of other applications, as previously described in connected with my declaration dated March 8, 1999.

11. However, on December 5, 1995, DSquared Development had not yet physically implemented a real-time grain monitor in a combine. My purpose in writing that letter was to attempt to obtain funding for the initial development of the concept. For example, in the December 5, 1995 letter, I estimated that it would take approximately 6 to 12 months to develop a suitable optical head design for such an application.

12. My first sketch of a spectrophotometer relating in any way to a combine or other real-time grain processing apparatus was made on January 24, 1996. On that date, I made a sketch in a technical notebook which I kept at the time. A copy of page 212 of that notebook, at which this sketch appears, is attached as Appendix B.

13. At the time of the December 5, 1995 letter, I had not yet determined how to design certain critical portions of the real-time grain monitor. For example, these included the specific type of optical detector to use, the wavelength region which would be best used in the intended application, how to adapt the sensor head to fit on a combine or other mobile agricultural equipment, how to select and orient the fiber optic, and how to arrange the components to obtain a light reference measurement.

14. My next written description relating to the proposed grain monitor occurred in connection with my preparation of a proposal to Lockheed Idaho Engineering in January of 1996. A copy of that document is attached as Appendix C.

15. Even the January 1996 proposal states that a "PBS" type detector array needs to be adapted to the existing photospectrometer" and that "a specific sensor head suitable for real time analysis of wheat need[s] to be designed". That proposal also estimates that at least 6 months would be needed to modify the spectrometer platform as it existed at that time and to develop a suitable sensor head.

16. The first actual prototype of such a spectrometer as adapted for use on a combine to measure grain properties in real time while it is being harvested was not completed until later in 1996.

17. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Sec. 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, and patent issuing thereon, or any patent to which this Declaration is directed.

David M. Mayes (DATE)

Appendix A

Bob Horning
Micro-Trak
P.O. Box 99
111 East LeRay Ave
Eagle Lake MN 56024

Dec 5, 1995

Dear Bob,

As per our conversation and am sending you additional information regarding our proposed real-time grain monitor. To recap our conversation, DSquared Development has developed technology that could be implemented to analyze grain and other agriculture products in real-time while being harvested. Mounted directly in a combine or similar implement, this device would work in concert with your GPS tracking system to map an entire field's production in terms of actual grain constituents (moisture, starch, protein, carbohydrates, etc.). This vital data could then be used with the data from your fertilizer applicator, using the same GPS system, to give direct feedback on amount of fertilizer applied to crop production and potentially other information. Furthermore, a university researcher has recently been working with a generic analyzer that we manufacture to evaluate non-destructively plant stress when subjected to different amounts of herbicides.

The technology that we have developed is based upon Near Infrared (NIR) spectroscopic analysis which has been an established method for measuring grain constituents since the late 1950s and is currently (I believe) considered as a standard analysis method. In the past, the instrumentation used for this analysis has been bulky, expensive, and not very rugged while recently, a few key components have become available along with technology developed by DSquared Development, that make a small, rugged monitor a reality. Accordingly, we are seeking to establish an alliance with a company in your market area. We feel that with your GPS tracking system along with your fertilizer control system and our grain monitor, a new era in agriculture management could be formed.

From our discussion, our monitor could easily be adapted to conform to your existing communication protocols. The following table outlines some key aspects of the device.

Real-time Grain Monitor Information

Power	6 to 28 VDC or 110 VAC ~ 1A
Size	9x9x3 inches (can be packaged into most any sizes and configurations pending upon application)
Analysis time	1-5 seconds (this is for a 3 or 4 component analysis)
Constituents analyzed	Multiple constituents could be predicted as well as the capability to measure different products such as wheat, barley, corn, etc.
Cost	Cost is quite volume dependent. At today's costs, the following price estimates can be made: 10 units/month $10,000/unit 100 units/month $5,000/unit In the next year, two of the most expensive components are projected to significantly come down in price. When they do so, 100 units/month should cost ~$2500/unit.
Development time for this application	6-12 months.

If you have any further comments and/or questions, please contact me.

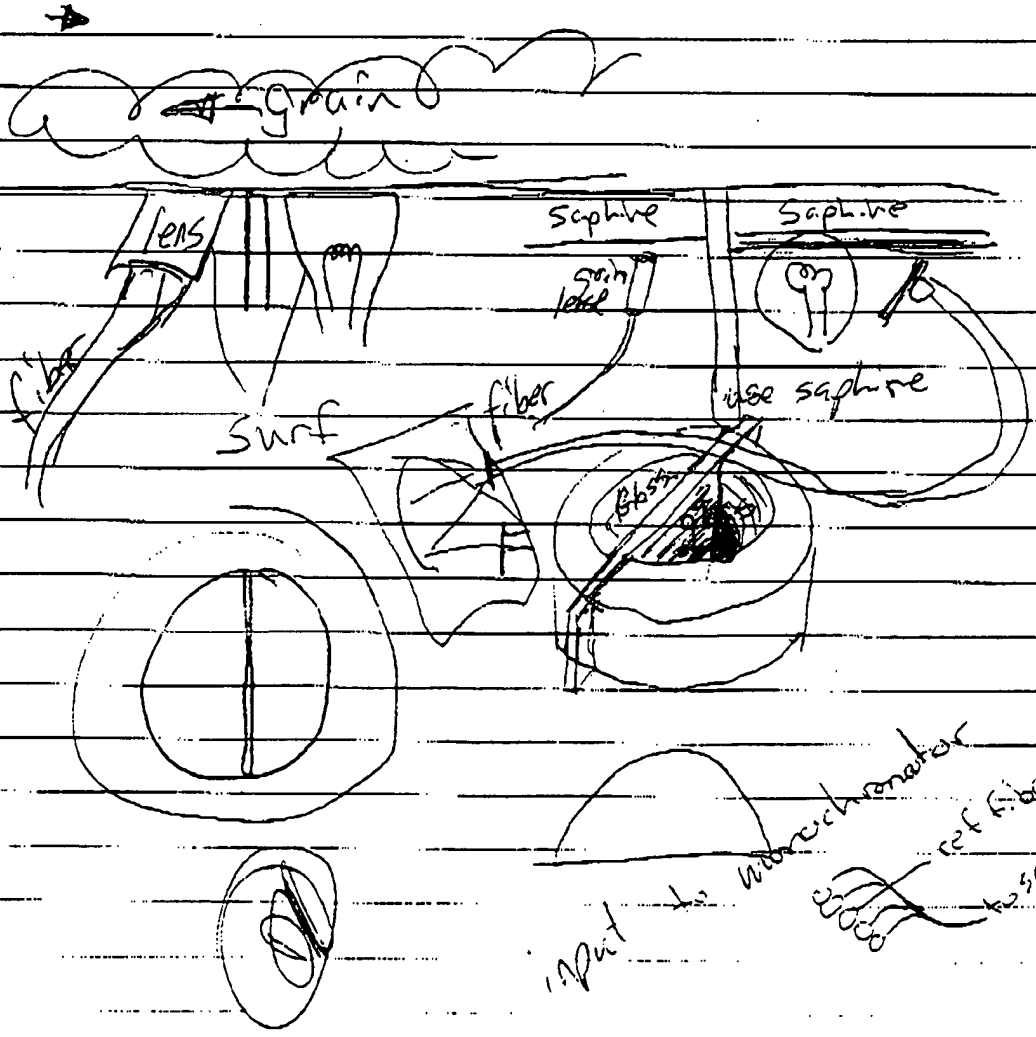
Sincerely,

David M. Mayes, Ph.D.
President

1-23-96

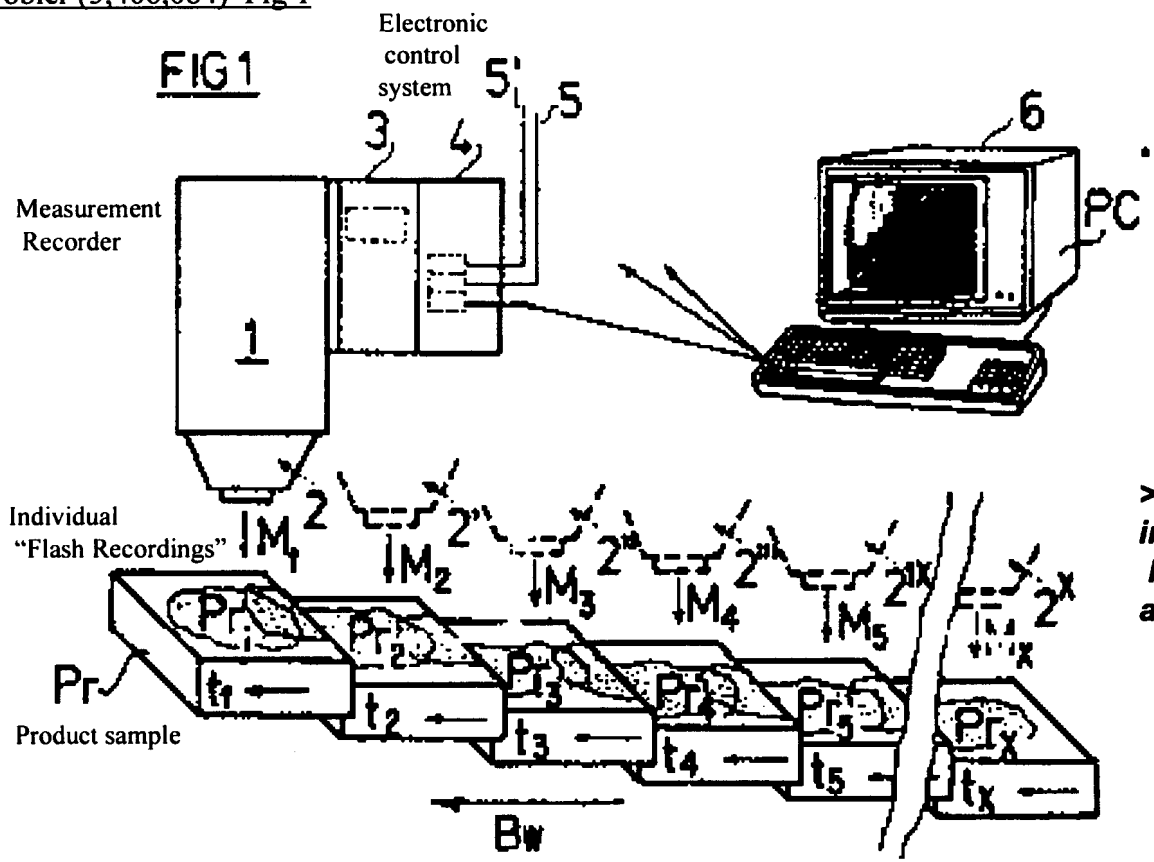
Tim Kelly - Tasked for the format
He said "OK"
He will send it today

1-24-96



In-line measurement system

Tobler (5,406,084) Fig 1



Measurement system
for in-line process control, for a
- continuous stream
- using light source with NIR wavelengths,
- detection at a plurality of wavelengths
- in a short time,
- repeating, and
- averaging
- to determine constituents of food product.

>> NIR Equipment prior to Dr. Mayes' invention unsuitable for a mobile platform, like a combine, or general agricultural use, and therefore, not conceived for combine use.

Dr. Mayes' contribution: a design enabling:

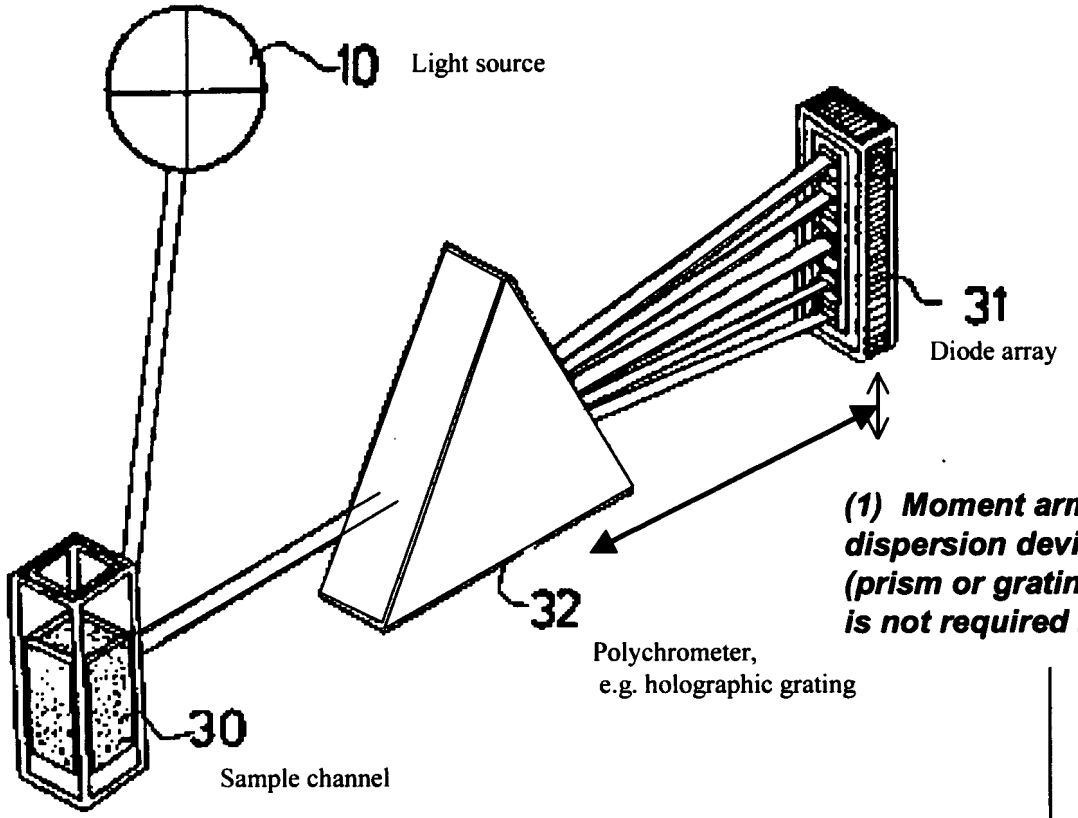
(i) a construction rugged enough for mobile applications, and

(ii) good enough to give useful results.

Appendix C

Measuring Apparatus using diode array

Tobler (5,406,084) Fig 7

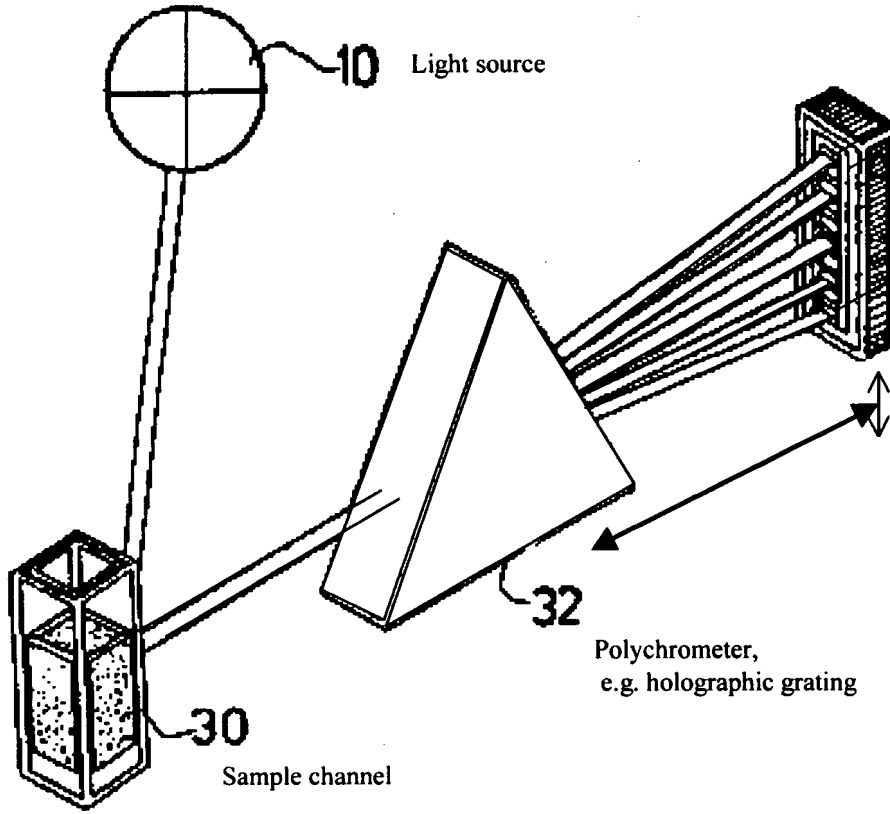


(1) Moment arm required by dispersion devices (prism or grating) is not required by Mayes' invention

(1) Moment arm ==> extended structure
==> sensitivity to vibration, accelerations, temperature, humidity...

Measuring Apparatus using diode array

Tobler (5,406,084) Fig 7



(2) A Diode array is not equivalent to a CCD because its readout is of instantaneous currents, and the pixels are polled sequentially.

In a CCD the pixels <u>accumulate charge in parallel</u>, for a given interval, and then are read out sequentially.

(2) CCD: *same grain particles* seen by each pixel,

Diode array: read-out constraint ==> *different grain particles* recorded from each pixel.